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FOREST SERVICE
U.S. DEPARTMENT OF AGRICULTURE

ROCKY MOUNTAIN FOREST AND RANGE EXPERIMENT STATION

In Vitro Digestibility of Alpine Forages in Wyoming

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At the time of maximum standing crop, 54 species of alpine plants formed a spectrum of digestibility ranging from 35 to 78 percent. The primary forage species were intermediate in the digestibility spectrum. Carex elynoides, red fescue, and American bistort were the most digestible of the primary forage species.

Over 300 sheep allotments and 40 cattle allotments in Colorado and Wyoming include some alpine range (Wasser and Retzer 1966). These alpine ranges also furnish forage for elk, deer, and bighorn sheep.

The quality of alpine forages is not well known. Smith and Johnson (1965) reported the seasonal variation in crude protein content of eight species in the alpine zone of the Medicine Bow Mountains. They found that crude protein content was normally adequate for lactating ewes during the summer grazing season. Average energy values of alpine plants are reported (Golley 1961) to be higher than values of plants at lower elevations. Bliss (1962) associated the high energy content of alpine plants with their high lipid content.

Johnston et al. (1968) described the chemical composition and cellulose digestibility of several alpine plants in southwestern Alberta. Those species, some of which occur in the alpine zone of the central Rocky Mountains, provided a nutritious forage for bighorn sheep during the summer.

This paper reports the in vitro digestibility of dry matter in 54 species of alpine plants (table 1).

The study area consisted of 6 square miles of alpine range in the Absaroka Mountains near Cody, Wyoming. Elevations in the area ranged from about 10,000 to 11,500 feet.

Plant materials were obtained by clipping herbage to ground level in a two-stage sample (Hansen et al. 1953). The first stage consisted of 29 units, each containing 36 square yards. The second stage consisted of 20 units each 1 x 1 foot.

Plant material was harvested over a period of 17 days--July 18-August 3--the approximate period of maximum standing crop for alpine species (Smith and Johnson 1965).

Plant materials were dried at 105°C. and composited by species. Digestible dry matter was determined in triplicate samples by the in vitro technique of Tilley and Terry (1963). Inoculum was obtained from a fistulated steer on a diet of good quality alfalfa hay. Because of the inoculum source, the digestion coefficients may be inexact. However, the coefficients establish the relative digestibility of the various species.

Results

The 54 species formed a broad spectrum of digestibility (table 1): Coefficients ranged from 78 percent for spikefescue to 35 percent for alpine forget-me-not.

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The primory forage species, those most abundant in the diet of sheep in this area, were Carex elynoides, red fescue, American bistort, bluegrosses, dwarf clover, whiproot clover, and golden avens. These species were of intermediote digestibility.

There were, however, considerable differences in digestibility among the primory forage species. Digestion coefficients for red fescue, American bistort, and Carex elynoides were equal ond relatively high (65 percent). Bluegrasses were only slightly less digestible. Digestibilities of dwarf and whiproot clovers were rather low (56 and 49 percent respectively), despite the fact thot proximate, minerol, ond vitamin anolyses emphasize their nutritionol odequacy for livestock and game animals (Hamilton 1961). The digestion coefficient for alpine avens, an abundant species of relatively low polatability, was only 42 percent.

These results include no measure of seasonal or annual variation. They are reported, however, because of the lack of specific information on quality of alpine forages.

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Table 1.--Percent in vitro digestible dry matter in composite samples of alpine herbage harvested July 18-August 3, 1967

Species	Mean ± standard error	Species	Mean ± standard error	Species	Mean ± standard error
Spikefescue *Hesperochloa kingii* (S. Wats.) Rydb.	78 ± 1.8	Scribner wheatgrass *Agropyron scribneri* Vasey	62 ± 0.7	Fernleaf fleabane *Erigeron compositus* Pursh	52 ± 0.7
Larkspur *Delphinium* sp.	77 ± 2.3	Sedge *Carex obtusata* Lilj.	62 ± 1.8	Sedge *Carex limnophila*	51 ± 3.5
Paintbrush *Castilleja* sp.	73 ± 3.5	Southern shootingstar *Dodecatheon radicatum* Greene	62 ± 1.4	Starry cerastium *Cerastium arvense* L.	50 ± 2.4
Western yarrow *Achillea lanulosa* Nutt.	70 ± 2.9	Ebony sedge *Carex ebenea* Rydb.	61 ± 2.3	Whiproot clover *Trifolium dasyphyllum* Torr. & Gray	49 ± 3.4
Kittentails *Besseya cinerea* (Raf.) Pennell	70 ± 2.4	Fleabane *Erigeron simplex* Greene	61 ± 2.3	Flowery phlox *Phlox multiflora* A. Nels.	48 ± 0.7
Lomatium *Lomatium montanum* Coult. & Rose	70 ± 2.9	Lupine *Lupinus greenii* A. Nels.	61 ± 1.2	Sheep fescue *Festuca ovina* L.	47 ± 2.0
Spike trisetum *Trisetum spicatum* (L.) Richt.	70 ± 3.5	Spike woodrush *Luzula spicata* (L.) DC.	61 ±<0.1	Snow willow *Salix nivalis* Hook.	46 ± 1.8
Fremont groundsel *Senecio fremontii* (Torr. & Gray)	69 ± 2.0	Bluegrass *Poa* spp.	61 ± 2.0	Arctic sandwort *Arenaria obtusiloba* Rydb.	45 ± 3.5
Oandelion hawksbeard *Crepis runcinata* Torr. & Gray	68 ± 1.4	Blackhead sedge *Carex albo-nigra* Mackenz.	60 ± 0.7	Phlox *Phlox pulvinata*	44 ± 2.4
Crazyweed *Oxytropis parryi* A. Gray	68 ± 0.7	Varileaf cinquefoil *Potentilla diversifolia* Lehm.	60 ± 1.8	Ballhead sandwort *Arenaria congesta* Nutt.	43 ± 2.3
Parry lousewort *Pedicularis parryi* A. Gray	68 ± 1.8	Parry clover *Trifolium parryi* A. Gray	59 ± 1.2	Golden avens *Geum rossii* (R. Br.) Ser.	42 ± 2.4
Littleflower penstemon *Penstemon procerus* Oougl.	68 ± 1.4	Alpine sagebrush *Artemisia scopulorum* A. Gray	58 ± 0.7	Alpine forgetmenot *Myosotis alpestris* Schmidt	42 ± 2.4
Sedge *Carex elynoides* Holm	66 ± 1.8	Tufted hairgrass *Deschampsia caespitosa* (L.) Beauv.	58 ± 0.7	Wormleaf stonecrop *Sedum stenopetalum* Pursh	42 ± 3.5
Sticky polemonium *Polemonium viscosum* Nutt.	66 ± 1.4	Oiamondleaf saxifrage *Saxifraga rhomboidea* Greene	57 ± 3.1	Alpine pussytoes *Antennaria alpina*	40 ± 2.7
Red fescue *Festuca rubra* L.	65 ± 2.3	Bluebells *Mertensia alpina* (Torr.) G. Don	56 ± 1.4	Alpine willowweed *Epilobium alpinum* L.	39 ± 1.2
Prairie junegrass *Koeleria cristata* (L.) Pers.	65 ± 2.3	Goldenrod *Solidago ciliosa* Greene	56 ± 0.7	Boreal sandwort *Arenaria rubella* (Wahl.) Smith	38 ± 1.8
Slender wheatgrass *Agropyron trachycaulum* (Link) Maite	64 ± 1.8	Owarf clover *Trifolium nanum* Torr.	56 ± 1.4	BearRiver fleabane *Erigeron ursinus* O. C. Eaton	36 ± 1.4
American bistort *Polygonum bistortoides* Pursh	63 ± 2.0	Pale agoseris *Agoseris glauca* (Pursh) O. Oietr.	54 ± 2.9	Alpine forget-me-not *Eritrichium elongatum* (Rydb.) Wight	35 ± 2.0

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